ON HIGH SCHOOL SCIENCE EQUIPMENT

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THE PURPOSE of this article is to offer a few suggestions about the equipment of high school science laboratories and classrooms.

A high school leaflet entitled, *Apparatus and Equipment Required for the Teaching of Science in the High Schools of North Carolina,* has been prepared by Professor J. Henry Highsmith, State Inspector of High Schools for North Carolina. It can be secured free by writing to Professor Highsmith at Raleigh, N. C. This leaflet gives, besides a few general suggestions, a special minimum list of high school laboratory apparatus, with the approximate cost of the same for the teaching of any state adopted high school text-book on (1) general science, (2) biology, (3) physics, and (4) chemistry. Some localities of the state, due to their agricultural, manufacturing, or other peculiar industrial interests need these courses (particularly the botany side of biology, and the fertilizer, tanning, vegetable oils, etc., sides of chemistry), modified to meet their own needs. For such places a more elaborate list of apparatus should be obtained for the school. Since, as a result of these particular local needs, there is quite a bit more specific apparatus that is desirable, not given at all by Professor Highsmith and only a part of which could be given here, we suggest that each high school science department first consult Professor Highsmith's list and then on the basis of these special agricultural, manufacturing and other local interests and needs work out for itself how much and what kind this additional apparatus must be. This article must confine itself to more general suggestions, covering the recitation rooms as well as the laboratories.

Considering the size and expected attendance of pupils in the average North Carolina high school building now being constructed and the approximately fifty per cent of these pupils who take science, we are limited in the amount of building space for each pupil and each branch of science. There should be in any school that makes any pretense at all to teach science at least two laboratories and two recitation rooms for science; ideally, a laboratory for one of the main science courses—physics, chemistry, biology, and general science. In case only the minimum space allowance is available, the subjects of physics and biology might use one of the laboratories together since for both of these subjects the pupils need comfortable tables and stools or chairs of about the same type in order to perform the experiments. The other laboratory could, then, be used for chemistry and general science.

The recitation rooms should have a demonstration table at which the science teacher performs experiments in the presence of the class. Light, blackboards, arrangements of seats, etc., might well be similar to the other recitation rooms or the movable type of desk chair used. However, an ideal recitation room should have the seats and desks raised and the windows provided with shades so arranged that the room can be darkened for lantern slides whenever desired. The demonstration table, box shaped, should be built in of substantial wood with drawers and closet for apparatus, lock, hood for fumes, sink and faucets of hot and cold water, gas jets, and electrical connections. The same list of special apparatus, like burners, test tubes, etc., as provided for each student in his desk according to Professor Highsmith's list should be included for the teacher's demonstration table. A case for holding the more common reagents is desirable. Additional apparatus or reagents or samples might be brought from the stock room or cases when needed. In the recitation room for chemistry charts giving the atomic weights, the electromotive series, and the periodic arrangement of the elements, should be hung on the front wall above the blackboard.

For the laboratories the desks or tables, seats, etc., can be selected by studying catalogues of standard equipment companies, the quality unfortunately too often having to depend on the available funds of a given school. Better still, firms like the L. E. Knott Apparatus Co., Central Scientific Co., are glad to send a representative to a school to assist in making blueprints of laboratory layouts, and in giving various suggestions on the selection and arrangement of laboratory equipment.

Each student should have an approximate table space of 2½ feet to 3 feet long and 18 to 21 inches wide and be provided with a chair or stool. For chemistry, ideal desks should have soapstone or specially prepared acid-proof maple tops, soapstone trough lengthwise through the table or sink on one side of each pupil, shelves above center of table for reagents, gas and water jet, and hood for each student. There should be a sink at each end of the laboratory table and a waste jar on the floor below. There should be

shelves for glass stoppered bottles of the reagents, where the bottles are plainly marked with a large label, printed with printer's ink and covered with a thin coat of paraffin, a number on the bottle corresponding to a number just below it on the shelf. In case more than a liter of some very common reagents are needed it is advisable to have three or five liter bottles of the reagents made up and siphons connected.

If the school does not have a small storage room, a very desirable small room where the stock apparatus and reagents should be systematically arranged, there should be large cases in the laboratories fitted with locks to hold them. The same general suggestions hold good for the physics and biology laboratory with the exceptions that the tables need not be so elaborate, but with wooden tops 1½ inches thick, not necessarily solid to the floor, no hoods, fewer sinks, but with especially comfortable stools or chairs and with uprights of some kind in the center of the tables from which to suspend physical apparatus.

In ordering apparatus and chemicals the following suggestions may prove helpful. Always order as large a quantity of material as you may need for some time, and buy standard amounts of material like chemicals as listed in the catalogues, such as 100g. or 1 lb; otherwise the cost of weighing out odd quantities and preparing these for shipment may amount to more than the cost of the chemicals. Catalogues will be sent on application to dealers and should be in every school. A list of the supplies needed may be sent to a number of firms for quotations on prices. With large orders sometimes considerable saving may be made by placing the order four or five months early and requesting the dealer to import duty-free such articles as are made cheaper than by American manufacturers. Higher prices must be paid for small orders placed for immediate delivery.

The following are the names and addresses of five of the larger firms from which chemicals, chemical and physical apparatus, laboratory furniture, etc., can be obtained.

L. E. Knott Apparatus Co., Boston, Mass.

Central Scientific Co., 412 Orleans St., Chicago, Ill.

Eimer and Amend, 2057 Third Ave., New York City.

Bausch and Lomb Optical Co., Rochester, N. Y.

Leonard Peterson and Co., 1234-48 Fullerton Ave., Chicago, Ill.

It is not possible in this brief space to suggest even a list of science books for reference. Certainly, however, every science department ought to have the bulletin prepared by Professor Highsmith, and a copy of Mills, W. T., *American School Building Standards.*

SUPPLIES

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IT IS OFTEN convenient when ordering or planning to order the high-school supplies for the year to have a list of such supplies with which to check the amount on hand and thus to estimate the needed amount to requisition. The following article has been prepared with this idea in mind, namely, as a check-list, and with the further idea that it may be helpful as a suggestion about what working tools teachers in high school ought to have.

High school supplies may be distinguished from permanent equipment in that supplies are of a more perishable nature, or, perhaps we might say, supplies are not built in or supplied with the building. Some supplies have to be replaced regularly every year, others not quite so often but regularly, while still others have to be replaced at more or less irregular intervals.

These supplies may be divided into three classes, namely: (1) necessary, (2) desirable, (3) possible. Necessary supplies may be said to be those that are absolutely necessary for the running of the school. That is to say, without this class of supplies it would be impossible to operate the school. One might define desirable supplies as those that are highly essential to the successful operation of the school but are not absolutely indispensable. Possible supplies are those that would be of decided value and help to the school but are not absolutely necessary, or so highly essential as either of the other two classes.

In the necessary list of supplies, i. e., those without which no school can operate, we have placed the following articles:—chalk, blackboard erasers, one of which will be needed for every three lineal feet of blackboard space, pointers, which may either be bought or secured from a nearby woods—two for each room; waste baskets—one for each room; trash cans, a rubbish burner, dust pans—one for each floor; floor oil and oilers, brooms, sweeping compound, disinfectant, ladder, wheelbarrow, rake, shovel, hoe, hammer, screwdriver, saw, pencil sharpeners—one for each room;